CLAIMS

1. A separation device, comprising:

one or more anode reservoirs;

a plurality of separation channels connected to said anode reservoirs, each of said separation channels having an interior bounded by a side wall;

one or more fluid interface ports formed in the side wall of one of said separation channels to provide access to the interior of the separation channel, wherein a separation medium disposed in the interior of the separation channel forms a virtual wall at the fluid interface port; and

at least one cathode reservoir multiplexed with two or more of said separation channels.

2. The device of claim 1, further comprising an electrode array coupleable to said reservoirs and said fluid interface ports.

3. The device of claim 1, wherein the device has an outer perimeter and a center and the separation channels connect the outer perimeter to the center.

4. The device of claim 1, wherein the fluid interface port has a dead volume that is less than about one nanoliter.

5. The device of claim 1, wherein the fluid interface port has zero dead volume.

6. The device of claim 1, wherein the fluid interface port comprises an array of apertures forming virtual walls.

7. The device of claim 1, wherein the fluid interface port has a diameter between about 25 μm and about 125 μm.

8. The separation device of claim 1, wherein the device is a capillary array electrophoresis plate.

9. The separation device of claim 1, wherein the device comprises an electrochromatographic system.

10. The separation device of claim 1, wherein the device comprises a pressure-driven chromatographic system.

11. The separation device of claim 1, wherein the device comprises an isoelectric focusing system.

12. A separation device, comprising:

an array of microfabricated separation channels formed at a surface of a first microfabricated substrate and a corresponding surface of a second substrate bonded to the surface of said first substrate, each of said channels having an interior bounded by a side wall, a first end and a second end;

an array of fluid interface ports formed in the side walls of said separation channels to provide access to the interiors of the separation channels, wherein a separation medium disposed in the interior of the separation channel forms a virtual wall at each of the fluid interface ports in the array;

an array of cathode reservoirs connected to the first end of each of the separation channels; and

an array of anode reservoirs, wherein at least one anode reservoir is connected to the respective second ends of at least two of the separation channels.

13. The separation device of claim 12, wherein the fluid interface port has a diameter between about 25 μm and about 125 μm.

14. The separation device of claim 12, wherein the first and second substrate are made of glass.

15. The separation of claim 12, wherein the first and second substrate are made of plastic.

16. The separation device of claim 12, further comprising an electrode array coupleable to said reservoir array layer.

17. The separation device of claim 16, wherein said electrode array is integral with the two substrates.

18. The separation device of claim 17, wherein the fluid interface ports are regularly spaced on one of said substrates to receive solutions from a parallel loading device.

19. The separation device of claim 12, wherein the first substrate includes an array of electrodes aligned with the fluid interface ports, the cathode reservoirs, and the anode reservoirs to make electrical contacts with a plurality of solutions in a combination of the fluid interface ports, the cathode reservoirs, and the anode reservoirs.

20. The separation device of claim 12, wherein the separation device has H holes, and wherein H is approximately equal to the number of samples to be simultaneously processed in the separation device.

21. The separation device of claim 12, wherein the separation device is made of a combination of glass and plastic.

22. The separation device of claim 12, further comprising an electrode array in electrical contact with the separation device.

23. The separation device of claim 12, wherein a plurality of fluid interface ports are disposed in one of said separation channels.

24. The separation device of claim 12, wherein the first substrate includes an array of electrodes aligned with the fluid interface ports to make electrical contacts with a plurality of solutions in the fluid interface ports.

25. The separation device of claim 12, wherein the fluid interface port has a diameter between about 25 μm and about 125 μm.

26. The separation device of claim 12, wherein the device is a capillary array electrophoresis plate.

27. The separation device of claim 12, wherein the device comprises an electrochromatographic system.

28. The separation device of claim 12, wherein the device comprises a pressure-driven chromatographic system.

29. The separation device of claim 12, wherein the device comprises an isoelectric focusing system.

30. A separation device, comprising:

a substrate;

a plurality of separation channels formed in said substrate, each of said separation channels having an interior bounded by a side wall;

a plurality of fluid interface ports formed in the side walls of said separation channels to provide access to the interior of the separation channel, wherein a separation medium disposed in the interior of the separation channel forms a virtual wall at the fluid interface port and wherein each separation channel of the plurality of separation channels includes at least one dedicated fluid interface port; and

an anode reservoir multiplexed to two or more of the plurality of separation channels.

31. The separation device of claim 30, wherein the fluid interface port has a diameter between about 25 μm and about 125 μm.

32. A separation device, comprising:

a substrate;

a plurality of separation channels formed in said substrate, each of said separation channels having an interior bounded by a side wall;

a plurality of fluid interface ports formed in the side walls of said separation channels to provide access to the interior of the separation channel, wherein a separation medium disposed in the interior of the separation channel forms a virtual wall at the fluid interface port and wherein each separation channel of the plurality of separation channels includes at least one dedicated fluid interface port; and

a cathode reservoir multiplexed to two or more of the plurality of separation channels.

33. The separation device of claim 32, wherein the fluid interface port has a diameter between about 25 μm and about 125 μm.

34. The device of claim 32, further comprising an array of electrodes coupled to the substrate.

35. The device of claim 32, wherein said plurality of fluid interface ports are regularly spaced in said substrate and adapted to engage a parallel loading device.

36. The device of claim 35, wherein the parallel loading device comprises a multi-headed pipetter.

37. The separation device of claim 36, wherein the parallel loading device comprises a pin for carrying and introducing the droplet of a liquid sample to the fluid interface port by contacting the virtual wall.

38. The separation device of claim 32, wherein the separation channels are disposed in a radial pattern on the separation device.

39. A method for injecting a liquid sample through a separation device, comprising the steps of:

connecting a cathode reservoir to respective first ends of two or more separation channels;

connecting an anode reservoir to respective second ends of two or more of said separation channels;

forming a droplet from the liquid sample;

directing the droplet to a virtual wall formed by a separation medium in a fluid interface port formed in a side wall of a separation channel; and

applying a voltage to the fluid interface port to draw the sample into the separation channel.

40. A method of forming a separation device for separating a sample into different components, comprising the steps of:

forming a plurality of separation channels in said separation device, each of said separation channels defined by an interior bounded by a side wall;

forming a plurality of fluid interface ports in the side walls of said separation channels to provide access to the interior of the separation channels, wherein each fluid interface port forms a virtual wall when the separation channels are filled with a separation medium; and

connecting an anode reservoir to two or more of the plurality of separation channels.

41. The method of claim 40, wherein the step of forming a plurality of fluid interface ports comprises removing portions of said side walls to define an aperture having a diameter between about 25 μm and about 125 μm.

42. The method of claim 40, wherein the separation channels are disposed in a radial pattern on the separation device.

43. A method of forming a separation device for separating a sample into different components, comprising the steps of:

forming a plurality of separation channels in said separation device, each of said separation channels defined by an interior bounded by a side wall;

forming a plurality of fluid interface ports in the side walls of said separation channels to provide access to the interior of the separation channels, wherein each fluid interface port forms a virtual wall when the separation channels are filled with a separation medium; and

connecting a cathode reservoir to two or more of the plurality of separation channels.

44. The method of claim 43, wherein the step of forming a plurality of fluid interface ports comprises removing portions of said side walls to define an aperture having a diameter between about 25 μm and about 125 μm

45. The method of claim 43, wherein the separation channels are disposed in a radial pattern on the separation device.